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Author 1	Chowdhury, A.
Author 2	Kirkpatrick, C.H.
Author 3	NA
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Abstract
The paper examines the impact of rising human resource (HR) endowments on the relative factor intensity and composition of manufactured exports of Singapore and Malaysia. Following the traditional approach, relative factor intensities are approximated by wage and non-wage value added per employee. The findings show that the manufacturing activities in both countries have become more HR intensive. While in Singapore, the HR upgrading has accompanied substantial upgrading of capital equipment, a wedge between the skill and capital upgrading appears to have developed in Malaysia. This seemingly peculiar phenomenon in Malaysia may have been due to the dominance of electronics assembling which is very capital intensive but requires little skill.

Human Resource, Factor Intensity, and Export Structure of Singapore and Malaysia

A. Chowdhury and C. H. Kirkpatrick

The paper examines the impact of rising human resource (HR) endowments on the relative factor intensity and composition of manufactured exports of Singapore and Malaysia. Following the traditional approach, relative factor intensities are approximated by wage and non-wage value added per employee. The findings show that the manufacturing activities in both countries have become more HR intensive. While in Singapore, the HR upgrading has accompanied substantial upgrading of capital equipment, a wedge between the skill and capital upgrading appears to have developed in Malaysia. This seemingly peculiar phenomenon in Malaysia may have been due to the dominance of electronics assembling which is very capital intensive but requires little skill. As far as export composition is concerned, it has become more HR oriented in Singapore as a result of the rise in the export shares (export structure effect) of those activities which have become more HR intensive (industry effect). But in the case of Malaysia, the export structure is dominated by electronics whose assembly is not HR intensive. As a result, Malaysia's manufactured exports have remained less HR oriented.

Introduction*

There exists a considerable amount of literature which seeks to demonstrate the role of technological ability and skilled manpower in determining a country's trade performance.[1] Given the existing pattern of resource endowments, the developing countries, which are relatively ill-endowed in terms of skills and technology, are expected to concentrate their efforts on the production and exports of manufactures requiring only limited inputs of skilled labour. The success story of the East Asian newly industrializing countries (NICs) which followed the dictates of such labour-intensive and export-oriented policies has been well documented. However, the phase of rapid growth based on labour-intensive manufactured exports has proved to be a relatively short one; the early period of surplus labour conditions has been exhausted and these economies are now facing the prospect of rising real wages. The problem has been aggravated by the increased protectionist threat from the old industrialized countries against the import of labour-intensive manufacturers from the NICs. In addition, the recent breakthrough in microelectronics based "new technology" (NT), which might demand higher

levels of skill in the manufacture of products hitherto produced by using unskilled labour, has given rise to the fear that the comparative advantage of labour-abundant developing countries will soon be eroded.[2]

Faced with the prospect of growing labour scarcities and rising real wages, the NICs (e.g., Singapore) and the "second-tier" countries (e.g., Malaysia) have embarked upon an ambitious programme of restructuring their industries away from low value added, labour-intensive products to high value added skill and capital-intensive activities.[3] The restructuring programme is expected to pre-empt the loss of competitiveness due to NT. An important component of the restructuring programme is the enhancement of human resource endowments.[4] The rise in the skill levels of the work-force in particular, and the educational levels of the population in general are expected to improve the technological competencies of nations, thereby enabling them to make technological "leap-frogging". It is against this backdrop that the role of skill or human resource (HR) in the manufacturing activities and trade of Singapore and Malaysia are examined here. While no two countries are identical in all respects, Singapore and Malaysia can be safely regarded as representative of the NICs and "second-tier" countries, respectively.

Skill Endowments in Singapore and Malaysia

Tables 1–3 present alternative indicators of the work-force skill composition in Singapore and Malaysia. The measures are admittedly crude, but together they provide a composite picture. Higher education in Singapore underwent massive reorganization in the 1970s and early 1980s. These include the merger of the Singapore University and the Nanyang University into a new university, the National University of Singapore (NUS), the establishment of the Nanyang Technological Institute (NTI). This represented a sharp increase in the facilities and can be expected to raise the higher education enrolments. But the largest increase in enrolments during the reference period (1965–82) has been in the secondary and vocational institutions which also underwent much reorganization. Besides demographic factors, this can perhaps be explained by the rigorous streaming and screening of students at various stages in Singapore. One must also mention that intake and output of the educational institutions in Singapore is guided by strict manpower planning.[5]

TABLE 1
Education Indicators in Singapore and Malaysia

No. Enrolled as Percentage of Age Group	*Singapore*		*Malaysia*	
	1965	*1982*	*1965*	*1982*
Secondary school	45	66	28	49
Higher education	10	11	2	5
Vocational school	3.8 (1970)	11.8 (1980)	0.1 (1970)	0.1 (1980)

SOURCES: World Bank (1985), Table 25. For the entry on vocational schools, the source is Ariff and Hill (1985), Table 5.13.

TABLE 2
Skilled Ratios in Singapore and Malaysia
(In percentages)

Year	*Singapore*	*Malaysia*
1957	N.A.	5.6
1970	6.7	8.0
1980	14.3	11.3

NOTE: The skill rates (presented here as percentages), developed by Keesing (1965), is the ratio of skilled to unskilled workers. Skilled workers include categories I (professional, technical, and managerial) and II (craftsmen and foremen); unskilled workers include categories IV (operatives), and V (labourers). There are, however, classification differences between countries. Data for Singapore refer only to manufacturing; for Malaysia they refer to the whole work-force but agricultural workers are excluded.

SOURCE: Ariff and Hill (1985), Table 5.3, derived from ILO and national sources.

TABLE 3
Average Annual Growth Rate of Enrolment/Intake
(In percentages)

Type	*Singapore (1980–85)*	*Malaysia (1981–85)*
Graduates (Universities)	10	16.8 (14.3)[a] (20.9)[b]
Technicians (Polytechs)	17	32.9
Skilled workers (Vocational Schools)	16	23.6

NOTES:
[a] Average annual growth of enrolments in the degree programme.
[b] Average annual growth of enrolments in the diploma programme.

SOURCES: Ministry of Trade and Industry (Republic of Singapore), *The Singapore Economy: New Directions*, Table 11.1, p. 113; and Government of Malaysia, *Fifth Malaysia Plan 1986–1990*, Tables 4.9, 4.10, pp. 150–51, 153.

Given the emphasis of planners on the improvement of skill levels of production workers, it is not surprising to see the large increase in enrolments in the vocational and secondary schools. The trend was maintained in the 1980s as can be seen from Table 2.

In Malaysia, only 2 per cent of relevant age groups enrolled in higher education in the mid-1960s. Starting from such a low base, one can expect a larger jump with the expansion of facilities and scope, and by the early 1980s the enrolment ratio more than doubled. The expansion of tertiary level education continued with the setting up of two new universities (the International Islamic University and the Northern University of Malaysia), and five branch campuses during the early 1980s. As can be seen from Table 3, enrolments in the degree and diploma programme of the universities during 1981–1985 increased at an average annual rate of 16.8 per cent.

One can also see similarities in the pattern of enrolment growth in both Singapore and Malaysia. In both the countries the largest growth has been in the polytechnic enrolments followed by that in the vocational and trade schools. As mentioned earlier, this perhaps reflect the emphasis of the planners on the skill levels of the production worker.

From the growth in enrolments at all levels of education it can be deduced that the general skill levels of the work-force has gone up. As can be seen from Table 2, the ratio of skilled to unskilled labour has doubled in both the countries over the past one to two decades. One can, thus, conclude that the endowment of human resources (HR) in Singapore and Malaysia has gone up during the period of 1960–80s.

If the HR endowment is generally rising, then the question is: has it been manifested in the factor use pattern of industries and factor orientation of manufactured exports? According to the basic Heckscher-Ohlin-Samuelson factor proportion theory, the industrial structure should become more HR intensive and skill orientation of manufactured exports should increase, with the increase in the supply of skilled manpower. This, therefore, brings us to the main consideration of the paper, namely the industrial and export manifestation of changing HR endowment. The impact of factor use pattern of the industrial activities will first be examined. But the well-known conceptual and data problems associated with the estimation of factor intensity needs to be restated at this stage. The discussion in the next section, therefore, begins with a brief review of these empirical issues.

Skill and Relative Factor Intensity

Data and Measurement Problems

While the ratio between capital and labour can be theoretically regarded as an index of relative factor intensity, measurement of capital remains a controversial issue as there is no natural unit for it. On the other hand, labour is not a homogeneous factor input. In a very broad sense, it is a combination of both unskilled and skilled labour and their contributions to value

added are bound to be different. However, measurement of labour—skilled and unskilled—pose less of a problem as they can be expressed in their natural units, say man-hours.

For example, skill-intensity of an activity can be measured directly if data on employment by occupation are available. In that case, the proportion of professional and technical personnel in the total employment can be taken as an index of skill-intensity. However, most industrial statistics do not record employment data by industry and occupation. In the absence of data on occupational structure of employment, one can estimate skill-intensity indirectly from the wage data. The share of wages in value added may be regarded as consisting of two components: compensation for unskilled labour and returns to skills acquired through education and/or training. In other words, the difference between the wage of an unskilled labourer and that of a skilled labourer represents returns to skills acquired. Thus, to the extent that differences in the wage levels reflect differences in productive skill levels, an industry paying a relatively high wage may be regarded as one that is relatively more skill intensive.

In the absence of any direct measure of capital, one can likewise use the relative level of non-wage component of value added per employee as an index of physical capital intensity. Since value added generated by any productive activity can be basically attributed to the physical capital and labour force employed, total value added per employee can be interpreted as a combined measure of the use of both physical capital and skills.

Measuring factor intensities according to each input's contribution to value added has, however, some limitations. To the extent that there exists monopoly power of either labour or capital, it can distort the estimation of factor contributions. For example, if workers in some industries have greater bargaining power than those in other industries, the relative wage levels may not reflect skill differentials. Likewise, excessive profits or quasi-rent may result in overestimation of physical capital's contribution to value added. In addition, inter-country comparisons of relative factor intensity may suffer from problems that are mainly statistical in nature. These may be due to differences in the product mixes of specific industry and can be pronounced with the aggregation of industry data. Despite these shortcomings, a number of empirical studies have found that wages and non-wage value added per employee provide reasonably accurate proxies for skill or HR and physical capital intensities of industries in many countries.[6] Thus, wages and salaries per employee are used to examine skill or HR intensity of the manufacturing sector for two time frames: early 1970s and early 1980s. In order to reduce the influence of cyclical factors, a three-year average is used. That is, the ratios were first calculated for individual years (1970–72 and 1981–83 for Singapore); (1971–73 and 1980–82 for Malaysia) and then averaged to obtain the factor use pattern during the early periods of 1970 and 1980.

Factor Use Pattern in the Manufacturing Sector

Tables 4 and 5 show the HR intensity of the manufacturing sector in the early periods of 1970 and 1980. As can be seen from the tables, HR (skill) intensity, measured as wages and salaries per employee, has gone up in all the industrial activities (except two—beverages and wood products except furniture—in the case of Malaysia) during the 1970s. In the case of Singapore, the increase is quite significant. The average HR intensity has gone up from 3.903 in the early 1970s to 8.348 in the early 1980s. However, this conclusion has to be qualified against the large wage increase granted by the National Wages Council (NWC) in 1979–80, reflecting a tight labour market situation in general.

Tables 4 and 5 also present coefficients of variation (standard deviation divided by mean). The coefficient of variation shows the degree of dispersion of HR intensity among different industrial branches in the individual countries. The Malaysian industrial branches show the greatest

TABLE 4
HR Intensity of Singapore's Manufacturing Sector (1970 & 1980)
(In $thousands of wages/salary per employee)

Code	*Industry*	*1970*	*1980*
312	Food	3.0844	6.4007
313	Beverages	4.6097	9.5358
314	Tobacco	4.1172	8.5950
321	Textiles	2.2271	5.1307
322	Wearing apparel except footwear	1.7024	4.4443
323	Leather products	1.9071	4.2691
324	Footwear	2.0035	4.4212
331	Wood products except furniture	3.1107	6.1891
332	Furniture except metal	3.0739	5.0366
341	Paper and paper products	2.0972	4.9693
342	Printing and publishing	3.8880	7.2517
351	Industrial chemicals	6.0252	9.9629
352	Other chemicals	3.6276	9.2962
353(354)	Petroleum refineries	16.1519	22.2338
355	Processing of jelutong & gum demar	2.9667	6.7577
356	Rubber products except rubber footwear	3.8960	7.2427
357	Plastic products	2.2281	4.7990
361	Pottery, china, earthenware & glass products	4.4091	9.4183
363	Clay products	3.2391	6.8565
364(365)	Cement & concrete products	3.6699	7.2397
369	Other non-metallic mineral products	4.8359	31.9428
371	Iron and steel	4.8812	10.4628
372	Non-ferrous metals	4.3737	8.6766
381	Fabricated metal products	3.6938	7.1200
382	Machinery except electrical	3.4881	7.8320
383	Machinery electric	2.8611	5.4940
384	Transport equipment	5.7370	10.1143
385	Professional & Scientific equipment	3.2299	5.4899
390	Other manufacturing products	2.0565	4.9118
Average		3.9030	8.3481
Coefficient of variation		0.6685	0.6802

SOURCE: Department of Statistics, *Census of Industrial Production* (various issues).

variations in HR intensity at the start of 1970. However, over the decade, the degree of dispersion in the Malaysian manufacturing sector has declined and resembles that of Singapore. On the other hand, the degree of dispersion in HR intensity among Singapore's industrial activities remained fairly constant during the decade of 1970. To some extent, this stability, however, reflects the working of the central bargaining process guided by the NWC.

A variety of factors may have been responsible for shifts in the pattern of factor use in the manufacturing sector of any economy. For example, changes in relative prices of factors, intermediate or final products may trigger shifts in the relative factor intensity. They may also be

TABLE 5
HR Intensity of Malaysia's Manufacturing Sector (1970 & 1980)*
(In $thousands of wages/salaries per employee)

Code	*Industry*	*1970*	*1980*
312	Food	2.0169	5.0238
313	Beverages	3.5661	0.7321
314	Tobacco	2.2663	3.8053
321	Textiles	1.5585	4.5939
322	Wearing apparel except footwear	1.0960	3.1295
323	Leather products	1.2669	3.7500
324	Footwear	1.6891	3.6111
331	Wood products except furniture	2.2601	0.5082
332	Furniture except metal	2.0366	3.9216
341	Paper and paper products	1.5565	4.4615
342	Printing and publishing	2.7986	5.9556
353	Industrial chemicals	4.2938	8.1633
352	Other chemicals	3.3813	6.6667
353	Petroleum refineries	12.7607	21.6667
394	Misc. petroleum & coal products	2.7946	5.0000
355	Rubber products	2.1683	5.0617
358	Plastic products	1.4653	3.7209
361	Pottery, china, earthenware	1.9789	4.5000
362	Glass & glass products	2.1985	6.6667
369	Other non-metallic mineral products	2.5373	5.3636
371	Iron and steel	3.0237	7.2000
372	Non-ferrous metals	3.6880	7.6471
381	Fabricated metal products	2.0968	4.9638
382	Machinery except electrical	2.2195	5.5224
383	Machinery electric	1.6355	4.8208
384	Transport equipments	2.6654	7.4725
385	Professional & scientific equipments	1.7507	5.7143
390	Other manufacturing products	1.3560	3.7879
Average		2.6474	5.4797
Coefficient of variation		0.8049	0.6650

SOURCE: UNIDO, *Industrial Development Review Series: Malaysia*; and Department of Statistics, *Survey of Manufacturing Industries—Peninsular Malaysia* (various issues).

induced by technological innovations, unrelated to relative price changes. An industry relying heavily on unskilled labour may want to improve its competitiveness by replacing unskilled labour with automated machines either because labour has become more expensive or to take advantage of a recent technological breakthrough. At the same time, the technological breakthrough itself could be induced by the rise in relative price of labour in the first place. Thus, there could be combinations of stimuli to industrial responses and precise identification of such factors would require the carrying out of a detailed study at the industrial branch level, and even at the firm level. Yet it is possible in a very heuristic way, to provide a profile of industries that have become

relatively more skilled intensive over the decade and their variations within and across individual countries.

The correlation coefficients between ranks of industries in terms of increase in HR intensity, increase in physical capital intensity and initial HR- and physical capital intensities are presented in Table 6. It seems that there are some variations in the industrial branches which have experienced growth in HR intensity. For example, high positive rank correlation between HR intensity in the early 1970s and increase in HR intensity implies that whatever skill upgrading there has been in Singapore, it happened in those industries which were already intensive in HR (high wage per employee) during the early years of 1970s. On the other hand, from the low rank correlation values for Malaysia it appears that skills in industries that were characterized by low wage levels in the early 1970s have tended to be upgraded over time. This trend is, however, also a reflection of the general upward surge in wages for unskilled labour that can be expected with the increase in industrialization and hence must be qualified.

TABLE 6
Rank Correlation of Increase in HR Intensity with Other Industry Characteristics

	Increase in HR Intensity (early 1970s to early 1980s)	
Correlation with	*Singapore*	*Malaysia*
HR intensity (early 1970s)	.812	.352
Physical capital intensity (early 1970s)	.690	.259
Increase in physical capital intensity (early 1970s to (early 1980s)	.719	.351

NOTE: Physical capital intensity is measured by non-wage value added per employee (for the use of such measures, see footnote 6).

SOURCE: As in Tables 4 and 5.

In Singapore, increases in HR intensity correlate significantly with the initial level of and increases in physical capital intensity. As a matter of fact, the rank correlation coefficients between the two for Singapore is found to be significantly high, implying greater replacement or substitution of unskilled labour with machines and equipment. This finding is not surprising in view of the vigorous industrial restructuring programme of the country. A relatively low rank correlation value between increases in HR and physical capital intensity in Malaysia points to the divergence in relative physical capital and HR intensities of Malaysian industries. That is, substantial skill upgrading may not have occurred in those industries where there has also been significant upgrading of capital equipment or an increase in automation. This phenomenon may be a reflection of the tremendous growth of semi-conductor assembling which is generally quite intensive in capital but at the same time depends heavily on unskilled workers. Moreover, the electronics industry operates mainly in the export processing zones where trade union activities are severely restricted.

Skill Endowment and Comparative Advantage

Having discussed the industrial manifestation of the enhanced HR endowments we now turn to delve into the possible impact of the changing endowments on the composition of manufactured exports. The particular issues addressed are: 1. whether manufactured exports from Singapore and Malaysia are becoming more HR oriented, and 2. if so, to what extent it is due to changes in relative factor intensity within industries and shifts in export software.

In classifying industries in terms of their factor orientation, it is a standard practice to rank the industries on the basis of United States manufacturing value-added data (see, for example, Lary 1968). A recent example of the use of the

TABLE 7
Factor Intensity Composition of Manufactured Exports, 1980
(% of total)

Country	*Unskilled Labour Intensive*	*Technology Intensive*	*Human Resource Intensive*
Singapore	35–40	35–40	25–30
Malaysia	60–65	5–10	10–15

NOTE: For details of the classification scheme used, see Krause (1982). The shares of agriculture resource intensive and mineral resource intensive exports have not been given.

SOURCE: Ariff and Hill (1985).

procedure is provided by Krause (1982) who identifies four factors of production—natural resources, unskilled labour, technology, and human capital. Commodities are classified in one of these four categories using U.S. data to identify the factor input used most intensively in the commodity's production. This procedure has been applied (with minor modifications) to ASEAN export data by Ariff and Hill (1985). The results of the exercise are summarized in Table 7. Of the two countries, Singapore has a significant concentration of technology and human capital-intensive exports. Malaysia has a high proportion of labour-intensive exports; but this is largely accounted for by one item, SITC 729, mainly semi-conductor component assembly activities, which in recent years constituted about half the country's exports. This is in line with our findings in the previous section.

An alternative method for assessing the factor orientations of manufactured exports has been employed in UNIDO (1986). By correlating factor endowments and revealed comparative advantage (RCA)[7] across 32 countries (composed of both developed and developing economies), it has first ranked 90 manufactured products (SITC 5–8 less 68) in terms of their skill-cum-technology and physical capital orientation of RCA. The factor orientation of a country's exports has been obtained by taking the weighted sum of factor orientation indices of RCA by industry, the weights being the commodity composition of that particular country's manufactured exports.

Following the UNIDO (1986) methodology, the skill or HR orientation indices of Singapore and Malaysia's manufactured exports are calculated for 1970 and 1980. The indices for both RCA and export composition at two-digit ISIC level are obtained from Ariff and Hill (1985, Tables 6.16 and 6.4). The skill orientation indices of country exports are presented in Table 8.

As can be seen, the HR orientation of exports has gone up in Singapore. The decline in HR orientation in Malaysia's exports can be accounted for by rapid shifts to unskilled labour-intensive manufactures, particularly assembling of semi-conductor components. In recent years, semi-conductor components constituted half the country's manufactured exports (Ariff and Hill

TABLE 8
HR Orientation of Country Exports

	HR Orientation of Exports		*Changes in HR Orientation Exports*		
	1970	*1980*	*Total Change**	*Industry Effect*	*Export Structure Effect*
Singapore	.258	.416	.158	.030	.025
Malaysia	.130	.076	−.054	−.184	.019

* Total Change = Industry Effect + Export Structure Effect + Cross Effects (see footnote 8).
SOURCE: Ariff and Hill (1985, Tables 6.16 and 6.4), and UNIDO (1986).

1985, p. 185). At the same time, the shares of skill-intensive products like chemicals and base metal products in manufactured exports have dropped quite dramatically. The skill-cum-technology orientation of chemicals has been found to be quite high by UNIDO (1986). The shift in HR orientation in Singapore's manufactured exports is dramatic. This is not surprising given its more advanced industrial structure and poorer resource endowment. These findings for Singapore are similar to those by Ariff and Hill (1985) and Wong (1984). It has been observed by Wong (1984) that industries in Singapore with high skill intensities tend to have high growth rates of direct exports and experienced increase in shares in the total.

For a better understanding of the above process, the change in the HR orientation of a country's exports should be broken down into two components: the "industry effect" and "export structure effect".[8] The industry effect stems from upgrading of the *production process*, while the export effect is due to change in the *product composition* of manufactured exports. As can be seen from Table 8, the decomposition exercise reveals that the industry effect is negative for Malaysia. The positive industry effect in the case of Singapore can be expected given its longer period of industrialization and a more advanced industrial structure. While the industry effect is negative in the case of Malaysia, the export-structure effect is positive. This points to the divergence in factor intensity of the production process and the product itself. For example, electronics which is generally classified as a high-tech, high value-added product has become a major industry and a leading export sector in Malaysia. But the part of the production process that is located in this country is not a high-tech one. The semi-conductor assembling which is the main electronic-related activity is found to be highly labour intensive.[9] Even in the case of Singapore, where the electronics industry has recently been significantly upgraded, it is still found to be highly dependent on the ready availability of unskilled workers (Pang 1987). This, therefore, highlights the danger of classifying the so-called high-tech products according to factor use pattern in the United States. While such classification may serve the purpose of developed countries where both "product design" and "production process" are located, this may be quite misleading for the developing countries which are engaged predominantly in assembling so-called high-tech components.

However, these observations have to be qualified as the analysis has been carried out at a very aggregate level. As mentioned before, the HR or skill orientation indices of country exports have been calculated by using indices for both RCA and export composition at two digit ISIC level. Therefore, one needs to supplement the above findings with an analysis based on more disaggregate trade and industry data. However, comparisons between industry and trade data are complicated by the familiar problem of obtaining a concordance between them. And it was not possible to calculate the skill-cum-technology orientation of RCA by industry at a sufficiently disaggregated level for two time frames to study the changes in factor-orientation of a country's exports.

However, UNIDO (1986) has calculated skill-cum-technology orientation indices of RCA by industry (at 3-digit SITC level) which can be used as a yardstick to identify skill and technology-intensive products and to examine their export shares. These indices for 1977 have been obtained by correlating RCA indices for 90 manufactured products (SITC 5–8 less 68) with skill-cum-technology (proxied by summing the ratio of skilled to unskilled labour and R & D expenditure per worker) endowments across 32 developing and developed counttries. According to the underlying concept, the values of factor orientation indices range between $+1$ and -1, implying, respectively, maximum concordance and disconcordance between factor endowment and comparative advantage. Therefore, if .25 is used as a cut-off point, one can identify roughly 20 products which are supposedly more skill-cum-technology oriented. These 20 products are listed in Table 9.

TABLE 9
Top 20 Skill-cum-Technology Intensive Manufactured Products (SITC 5–8 Less 68)

SITC	Industry	Skill-cum-technology orientation of RCA	
		Value	Rank
726	Electrical apparatus for medical purposes	.580	1
599	Chemical materials & products, n.e.s.	.538	2
698	Manufacture of metals, n.e.s.	.506	3
734	Aircraft	.500	4
718	Machines for special industries	.382	5
695	Tools for use in the hand or in machines	.366	6
514	Other inorganic chemicals	.361	7
581	Plastic materials, regenerated cellulose, resins	.359	8
512	Organic chemicals	.335	9
541	Medicinal & pharmaceutical products	.322	10
862	Photographic and cinematographic supplies	.302	11
553	Perfumery and cosmetics except soaps	.302	12
571	Explosives & pyrotechnic products	.289	13
719	Machines, appliances (excl. electric) parts	.287	14
621	Materials of rubber	.284	15
533	Pigments, paints, varnishes & related product	.281	16
714	Office machines	.276	17
554	Soaps, cleansing & polishing preparations	.272	18
729	Other electrical machinery & apparatus	.270	19
664	Glass	.262	20

SOURCE: UNIDO (1986), Table II.1.

Assuming that the list which has been derived from a sample of 32 developed and developing countries will be fairly representative, Singapore and Malaysia's export shares of the top 20 skill-cum-technology intensive products are presented in Table 10. On examination of Table 10 no clear-cut evidence of shift in export structure towards more skill and technology-intensive products emerges. In both the countries export shares have changed in a very mixed way. Over the period of ten years, the share of skill-cum-technology intensive manufactured exports has gone up in some cases, while in other cases it has declined. In the case of Singapore, the share of eight products (SITC 512, 541, 581, 599, 664, 719, 729, 734) has registered an increase. As opposed to this, the share of only five skill-cum-technology intensive products has gone up in the Malaysian manufactured export. It has been found (at the 2-digit level) that HR orientation of Malaysia's manufactured exports has declined (Table 8). It may be mentioned that the HR orientation of a country's exports is a weighted sum of HR orientation of RCA by industry, the weights being the commodity composition of the country's manufactured exports. From the findings at the 3-digit level (Table 10), the decline in the HR orientation of Malaysian exports can therefore be attributed primarily to the failure of the skill-cum-technology intensive products to raise their export shares significantly enough to offset the negative industry effect. On the other hand, the moderate rise in Singapore's export shares of similar products has added to the positive industry effect to result in an increase in the HR orientation of exports.

TABLE 10
Share of Top 20 Skill-cum-Technology Intensive Products in Manufactured Exports (SITC 5-8 Less 68)

	Singapore		*Malaysia*	
SITC	*1970-72*	*1981-83*	*1970-72*	*1981-83*
726	.0004	.0004	.000	.0002
599	.0090	.0125	.0077	.0092
698	.0080	.0077	.0083	.0069
734	.0116	.0179	.0187	.0170
718	.0362	.0341	.0319	.0083
695	.0053	.0044	.0017	.0009
514	.0043	.0021	.0033	.0004
581	.0108	.0116	.0094	.0045
512	.0063	.0163	.0061	.0038
541	.0151	.0156	.0275	.0054
862	.0025	.0018	.0006	.0007
553	.0041	.0021	.0055	.0025
571	.0012	.0007	.000	.0002
719	.0333	.0648	.0413	.0318
621	.0016	.0012	.0248	.0081
533	.0047	.0039	.0044	.0009
714	.0619	.0040	.0033	.0013
554	.0076	.0039	.0165	.0036
729	.1056	.1495	.0121	.4962
664	.0016	.0019	.0006	.0029

SOURCE: UNIDO (1986).

Concluding Remarks

The limited data available suggest that skill and human resource (HR) endowments in Singapore and Malaysia have risen over the recent decades. Given this finding, this paper sought to investigate the impact of rising HR endowments on the relative factor intensity and composition of manufactured exports. It has been found that the manufacturing activities in both Singapore and Malaysia have become more intensive in the use of HR. However, the pattern of change in HR intensity is different in two countries. In Singapore, the skill or HR upgrading has occurred in activities which were already skill intensive in the early 1970s and the skill upgrading has accompanied substantial upgrading of capital equipments or automation. On the other hand, a wedge between the skill and capital upgrading appears to have developed in Malaysia. This, perhaps, is due to the dominance of electronics assembly operation which contributes roughly 66 per cent to the manufacturing value added. Electronics assembly, although highly capital intensive, is very much standardized in its operation and does not require a high skill level.

The impact of changing HR endowments on the composition of exports shows the same trend. The exports from Singapore have become more HR oriented. This is due to both industry and export structure effects. On the other hand the HR orientation of Malaysian exports has declined due mainly to industry effect. This can be explained also by the dominance of the electronics sector which accounts for more than half of Malaysian manufactured exports. While electronics is traditionally classified as a high-tech, HR intensive product, the particular production process (assembling) that is located in Malaysia is very much labour-intensive. Thus, one can find a rise in HR orientation due to export structure effect (based on product classification); but the industry effect shows a decline in HR orientation.

The findings of this study conform, broadly, with the stages theory of comparative advantage. With the level of development, Singapore moved towards specializing in more HR intensive activities in the 1980s. On the other hand, the factor use pattern of the Malaysian manufacturing sector and the export composition in the 1980s resembles those of Singapore in the early 1970s. But the trend indicates that the specialization is shifting towards HR intensive activities. However, this shift is likely to be a very slow process in both Singapore and Malaysia.

NOTES

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1. See, for example, L. Cheng, "International trade and Technology: A Brief Survey of the Recent Literature", *Weltwirtschaftliches Archiv* 120, no. 1 (1984).
2. *World Development* 13, no. 3 (1985) has a comprehensive discussion of related issues.
3. For details, see D. Lim, *Industrial Restructuring in Singapore* (Bangkok: ILO-ARTEP, 1984) and MIDA/UNIDO, *Medium and Long Term Industrial Master Plan: Malaysia (1986–1995)* (Kuala Lumpur, 1985).
4. For details, see R. Amjad, ed., *Human Resource Planning: The Asian Experience* (New Delhi: ILO-ARTEP, 1987), Chapters 3 and 4.
5. Op. cit.
6. See, for example, Balassa (1979), Dijck (1986), Lary (1968), Noland (1987), UNIDO (1985, 1986).
7. $$RCA_{ij} = \frac{(X_{ij} - M_{ij})}{T_i(T_{jw}/T_w)}$$

   where i = country
   j = product
   X = exports
   M = imports
   T = total trade $(X + M)$
   w = world.
8. Following UNIDO (1986) HR orientation of RCA is obtained by correlating human resources (HR) endowments and RCA across countries. The HR orientation of a country's export is the weighted sum of HR orientation of RCA by industry, the weights being the commodity composition of the country's manufactured exports.

   That is $$\sum h_i e_{ij}$$

   where h_i is the HR orientation of ith industry's *RCA* and e_{ij} is the share of ith product in the jth country's manufactured exports. The change in the HR orientation of the jth country's export is decomposed as

   $$\sum_i h_i^8 e_{ij}^8 - \sum_i h_i^7 e_{ij}^7 = \sum_i h_i^7 (e_{ij}^8 - e_{ij}^7) + \sum_i e_{ij}^7 (h_i^8 - h_i^7) + \sum_i (h_i^8 - h_i^7)(e_{ij}^8 - e_{ij}^7)$$

   where $\sum_i h_i^7 (e_{ij}^8 - e_{ij}^7)$ = Export structure effect

   $\sum_i e_{ij}^7 (h_i^8 - h_i^7)$ = Industry effect

   $\sum_i (h_i^8 - h_i^7)(e_{ij}^8 - e_{ij}^7)$ = Cross effect

   and the superscripts refer to two periods 1970s and 1980s.
9. This phenomenon of separation between stages of product development and production process is, in general, an outcome of recent technological breakthroughs in transport and communication and international sourcing of multinationals. For details, see F. Frobel, J. Heinrichs, and O. Kreye, *The New International Division of Labour* (Cambridge: Cambridge University Press, 1980) and J. R. Peet, "International Capital International Culture", in *The Geography of Multinational*, edited by M. Taylor and N. Thrift (London: Croom Helm, 1982).

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A. Chowdhury is a Lecturer in the Department of Economics, University of New England, Armidale, NSW, Australia.

C. H. Kirkpatrick is Professor of Development Economics, Project Planning, Centre for Developing Countries, University of Bradford, U.K.